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Long-term hydrological, hydro-chemical and hydro-geophysical observations of deep-seated landslides: the OMIV observation strategy for modelling landslide water circulation.

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The ability to document, and further understand, the dynamics of gravitational instability has mostly to be carried out using non-invasive techniques or through modelling. This is particularly the case for deep-seated landslides (e.g. depth up to 500 m) controlled by hydrology where the storage and circulation of water are controlled by the slope structures (bedrock, faults, macro/micro-porosity) and by interactions between physical, geochemical and even biological processes occurring in highly heterogeneous and often variably saturated media.
These complex and multiscale interactions are difficult to observe and thus hinder our ability to understand, and ultimately forecast, the evolution of the unstable slopes. Since more than 10 years, the French Landslide Observatory (OMIV: ano-omiv.cnrs.fr) has deployed a multi-sensor concept associating hydrological, hydro-chemical and hydrogeophysical observations to monitor the long-term dynamics of the slope.
The strategy consists in charactering the system properties (e.g. permeability, storage capacity) and states (water content, water flows, water quality) using traditional in situ “point-scale” sampling of the subsurface (springs) and in-depth (boreholes) waters together with hydro-geophysical imaging (mostly media resistivity) along cross-sections or even in 3D across the complete slope.
These approaches allow to gain a better understanding of the hydrological balance and to propose hydrological concepts for the investigated landslides.
The objective of this presentation is to present the time series of hydrological hydro-chemical and hydrogeophysical parameters acquired on three deep-seated landslides in France (Séchilienne, Pégairolles, La Clapière), the hydro-geophysical models acquired on these slopes, and the results of geochemical modelling of the rock-waters interactions.
Hydrological concepts of water storage and circulation are proposed and discussed for each unstable slope as a basis for the hydrological modelling of the groundwater variations.